

NSLS-II Science Planning and User Access



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**U.S. DEPARTMENT OF
ENERGY**

Office of
Science

5-II Science Strategy Builds Upon over 30 Years of Outstanding Scientific Productivity at NSLS

- **NSLS Tradition and Strengths:**

- Broad range of science & industrial programs
- Diverse capabilities in broad spectral range
- Highly engaged and productive user community from academia, industry, and government labs

- **High Productivity & Impact**

	<u>FY13</u>	<u>Since 1982</u>
• Users	2,367	~ 19,000
• Publications	881	17,182
• Protein Databank Deposits	~ 600	7,122
• 2 Nobel Prizes (2003, 2009)		

- **Future of NSLS-II:**

- Develop world leading capabilities of NSLS-II and leverage them to enable and conduct a broad range of high-impact and discovery class science and technology programs, including support of industry research



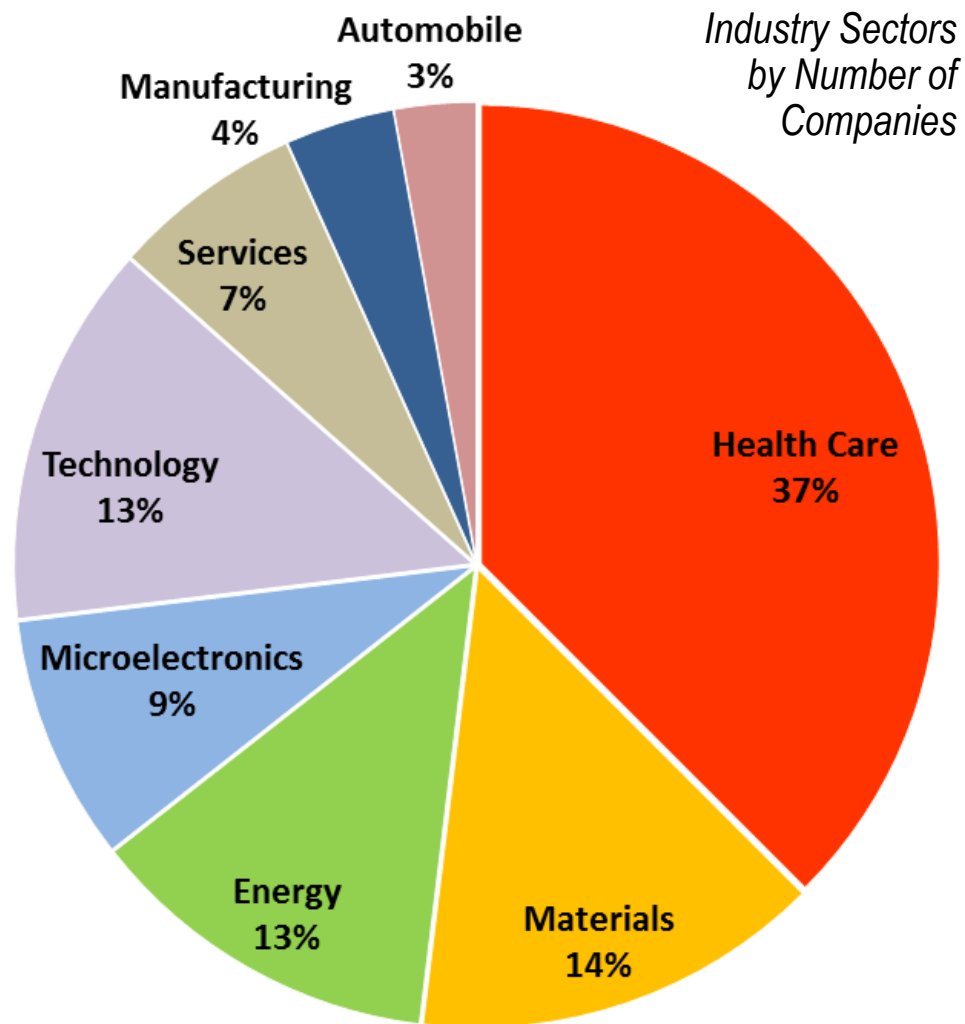
Work Conducted at NSLS Supports a Wide Range of Industry Sectors

- Majority of industrial research is on basic material structures at the molecular and atomic levels

- Petrochemicals
- Polymers
- Catalysts
- Pharmaceuticals
-

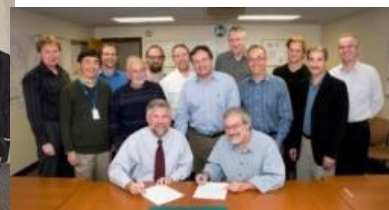
- Significant work on in-situ systems engineering and prototype manufacturing processes

- Thermal annealing
- Purification
- Battery cycling
- Mechanical stress tests
-



Community Engagement in Strategic Planning Process

- NSLS-II Strategic Planning is informed by many years of community engagement during the conceptualization and construction phases of NSLS-II, including:
- Community input from a large number of scientific workshops for strategic planning, beamline development, first experiments, & other topical forums
- Advice and input from Science Advisory Committee, beamline development review panels, and Beamline Advisory Teams
- Scientific grand challenges identified by DOE-BES, Priority Research Directions in Basic Research Needs series, and grand challenges in other areas of science (DOE-BER, NIH, NAS, ...)



NSLS-II Strategic Planning Approach



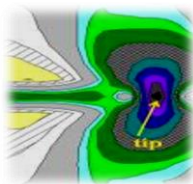
Using this approach ensures that the NSLS-II beamlines and overall facility stay at the cutting-edge and are responsive to evolving science needs

Priority Research Areas & Crosscutting Themes

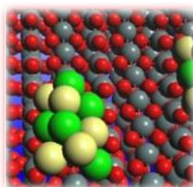
Priority Research Areas



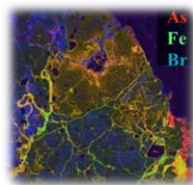
Emergent Behavior
from Complexity



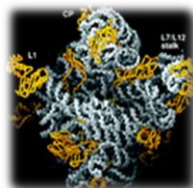
Materials Synthesis
& Properties



Energy Systems
and Materials

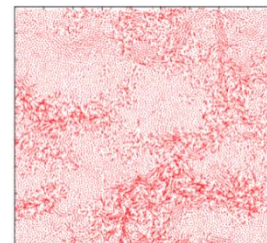


Environment and
Earth Ecosystem

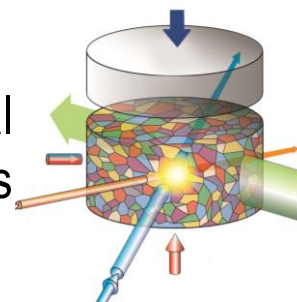


Structures and
Functions of Life

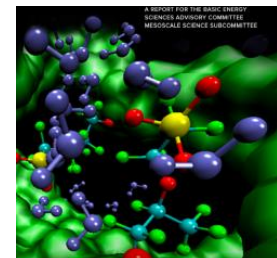
Complexity
& Dynamics



Functional
Systems

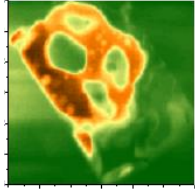


Multiscale &
Mesoscale

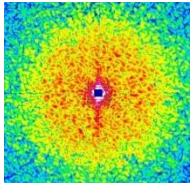


Crosscut Science Themes

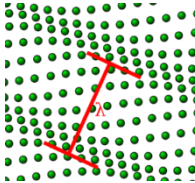
Science Needs Drive the Development of NSLS-II Beamlines



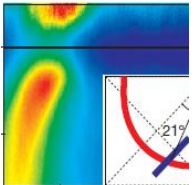
- Nanoscale and Mesoscale Imaging



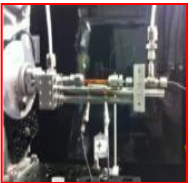
- Coherent Scattering and Imaging



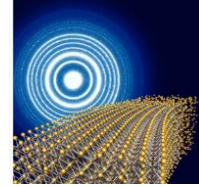
- Inelastic X-ray Scattering



- Photoelectron and Soft X-ray Spectroscopy



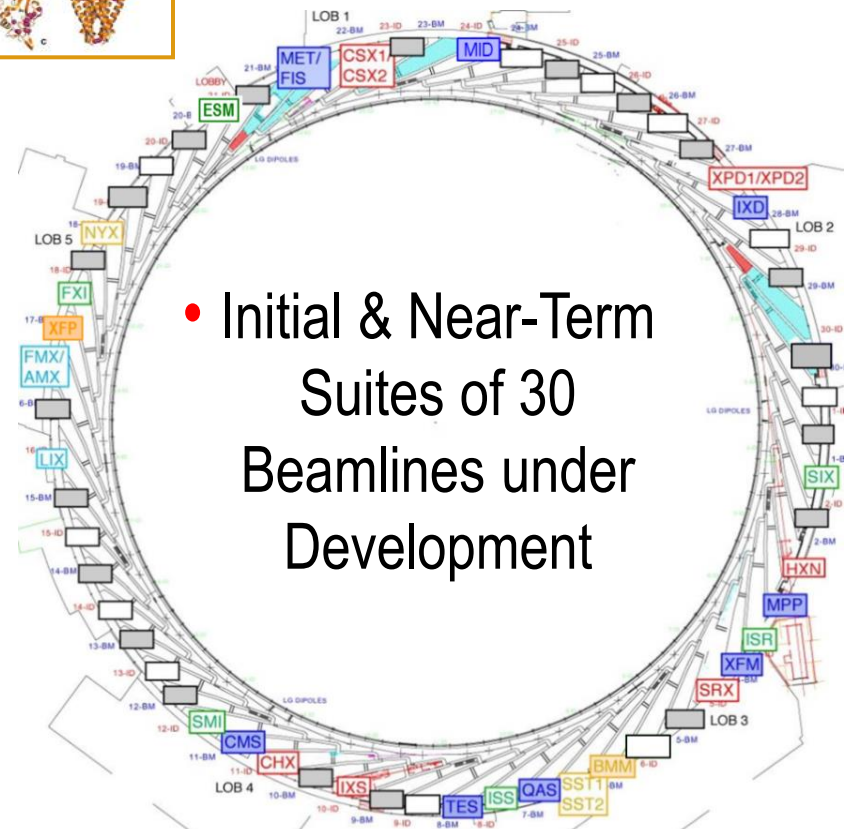
- In-situ & In-operando Diffraction & Spectroscopy (from IR to X-rays)



- X-ray Scattering for Soft Matter



- Structural Biology



- Initial & Near-Term Suites of 30 Beamlines under Development

Development Process of NSLS-II Beamlines

2010 Call for Beamline Development Proposals National Synchrotron Light Source II

March 26, 2010



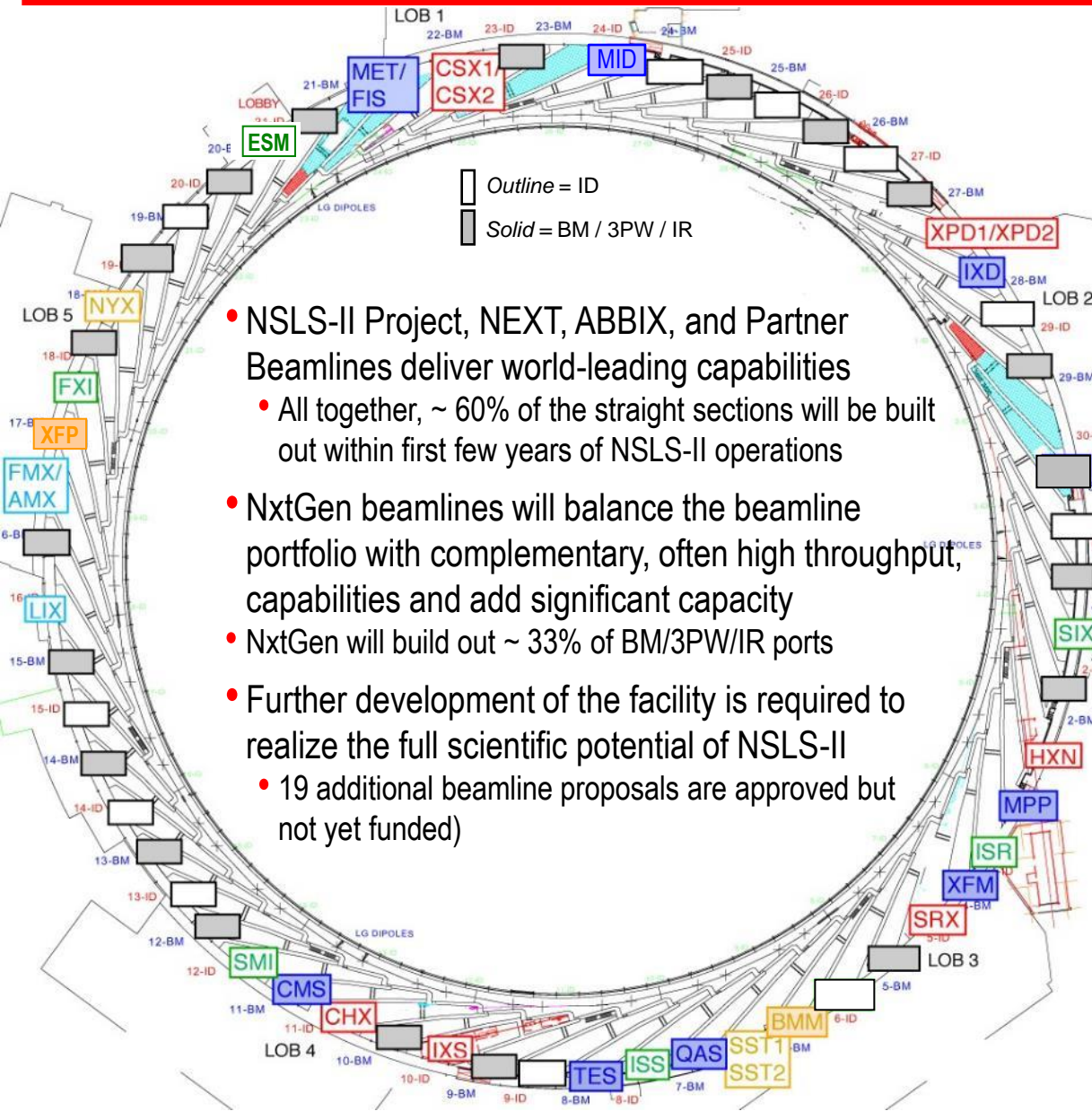
NSLS-II Beamline Development Process

- Call for Beamline Development Proposals (BDPs)
- Information Meetings and Workshops
- SAC Study Panel Reviews of BDPs
- Full SAC Review and Recommendations
- Approval of Proposed Beamlines (CD-0 equivalent)
- Seeking Funding for Development of Specific Approved Beamlines

- Beamline Development Proposals:
 - Three rounds of Beamline Development processes in 2008 (Letters of Intent), 2010, and 2011, covering all areas of science and beamline types – ID, BM, 3PW, IR
- Overwhelming Response from Community:
 - 82 Beamline Development Proposals (BDPs) received
 - Over 400 scientists in BDP proposal teams
- Results Based on SAC Recommendations:
 - 49 BDPs approved, with 30 under development

NSLS-II Beamline Portfolio

30 Beamlines Under Development



- NSLS-II Project, NEXT, ABBIX, and Partner Beamlines deliver world-leading capabilities
 - All together, ~ 60% of the straight sections will be built out within first few years of NSLS-II operations
- NxtGen beamlines will balance the beamline portfolio with complementary, often high throughput, capabilities and add significant capacity
- NxtGen will build out ~ 33% of BM/3PW/IR ports
- Further development of the facility is required to realize the full scientific potential of NSLS-II
 - 19 additional beamline proposals are approved but not yet funded)

8 NSLS-II Project Beamlines

Inelastic X-ray Scattering (IXS)
 Hard X-ray Nanoprobe (HXN)
 Coherent Hard X-ray Scattering (CHX)
 Coherent Soft X-ray Scat & Pol (CSX1, CSX2)
 Sub-micron Res X-ray Spec (SRX)
 X-ray Powder Diffraction (XPD1, XPD2)

6 NEXT Beamlines (DOE MIE)

Photoemission-Microscopy Facility (ESM)
 Full-field X-ray Imaging (FXI)
 In-Situ & Resonant X-Ray Studies (ISR)
 Inner Shell Spectroscopy (ISS)
 Soft Inelastic X-ray Scattering (SIX)
 Soft Matter Interfaces (SMI)

3 ABBIX Beamlines (NIH)

Frontier Macromolecular Cryst (FMX)
 Flexible Access Macromolecular Cryst (AMX)
 X-ray Scattering for Biology (LIX)

5 Partner Beamlines

Spectroscopy Soft and Tender (SST1, SST2)
 Beamline for Mater. Measurements (BMM)
 Microdiffraction Beamline (NYX)
 X-ray Footprinting (XFP)

8 NxtGen Beamlines

Complex Materials Scattering (CMS)
 Magneto, Ellipso, High Pressure IR (MET/FIS)
 Metrology & Instrum Development (MID)
 In-situ X-ray Diffraction Studies (IXD)
 Materials Physics & Processing (MPP)
 Quick X-ray Absorption and Scattering (QAS)
 Tender X-ray Absorption Spectroscopy (TES)
 X-ray Fluorescence Microscopy (XFM)

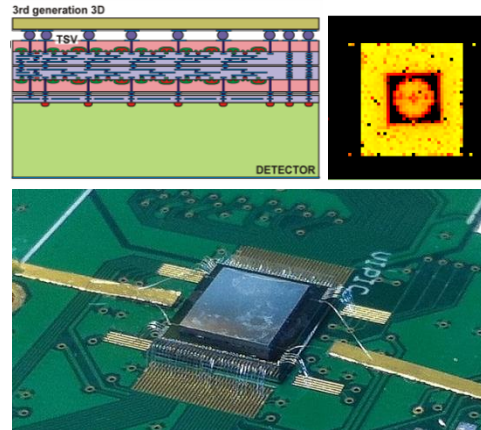
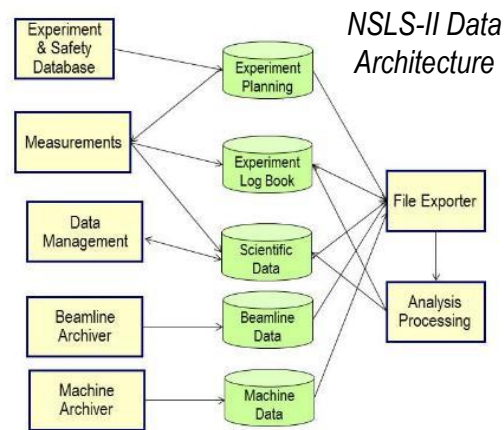
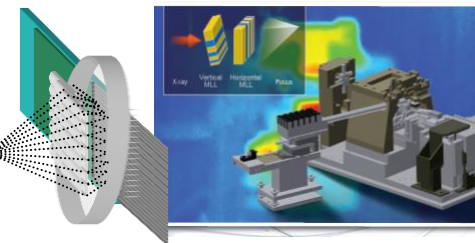
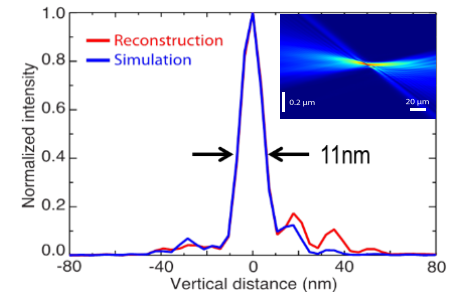
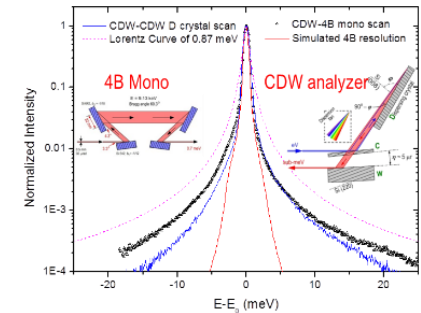
NSLS-II Beamline Development Timeline

- Through the open beamline development proposal process, we have identified forty nine beamlines to be developed at NSLS-II in the near to medium term, and are currently developing thirty such beamlines through **NSLS-II Project**, **NEXT**, **ABBIX**, NxtGen, and **Partner** beamline projects
- These beamlines will be completed and start operations in the 2015-2017 timeframe

FY13	FY14	FY15	FY16	FY17	FY18	FY19
		NSLS-II Project Beamlines				
			ABBIX Beamlines			
					NEXT Beamlines	
						NxtGen & Partner Beamlines

Enabling R&D and Computing: Critical to NSLS-II Mission

- Optics & Detectors R&D in Targeted Areas:
 - Nanofocusing X-ray optics: to achieve ~ 1 nm focus
 - Nano-precision engineering: to enable ~ 1 nm microscope
 - High energy resolution crystal optics: to achieve ~ 0.1 meV
 - Advanced optical metrology: for ultralow slope-error optics
 - Novel pixel array detectors: to enable fast smart data acquisition
 - Infrastructure for sample environment and ancillary instruments
- Advanced Computing and Data Management:
 - Data rates & volumes and complexity of 'datasets' require high-performance data management and dedicated visualization & analysis software tools for both during- and post-experiments



Targeted Programmatic Initiatives

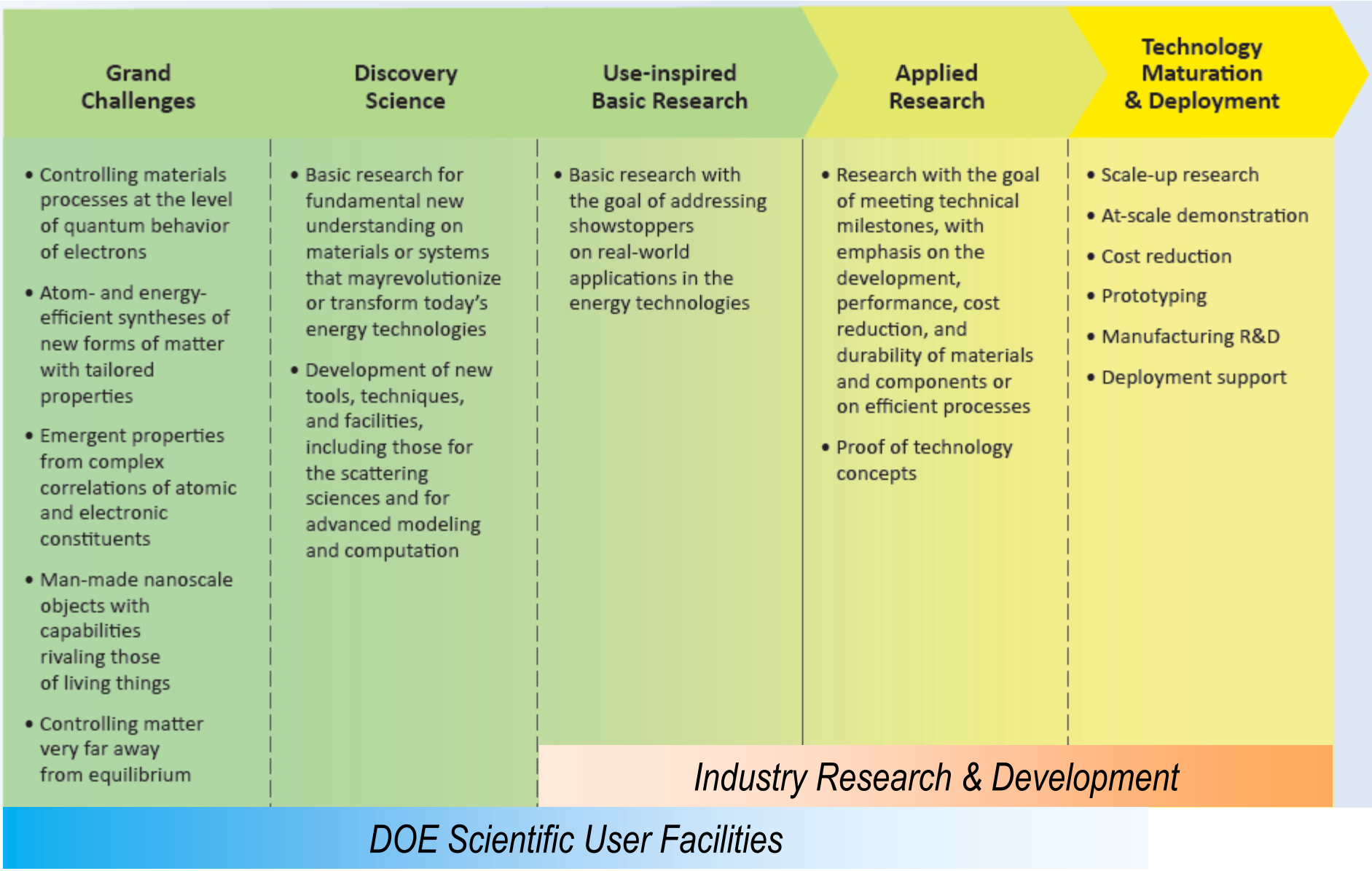
- Work with community to identify & develop targeted programmatic initiatives where we can play active roles in developing integrated research programs:
- To engage scientific and industry community via workshops, seminars, other outreach activities
- To drive and coordinate development of special equipment & user access modes at beamlines and support laboratories (e.g. sample cells, ancillary instruments, and analysis software)
- Several successful consortia/partnerships at existing synchrotron facilities provide models to build on: SCC, COMPRES, HP-Sync
- Help users at specific beamlines and help promote the science of interest
- We are very much interested in working with industry, developing ways to enhance industry user access & support at NSLS-II

Partnering with Community

NSLS-II plans continue to partner with the scientific community and leveraging their interests, expertise & investments

- *Synchrotron Catalysis Consortium (SCC)*
- *Consortium for Materials Properties Research in Earth Sciences (COMPRES)*
- *Center for Emergent Superconductivity (CES)*
- *National Institute of Science & Technology (NIST)*
- *NY Structural Biology Center (NYSBC)*
- *Case Center for Synchrotron Biosciences (CSB)*
- *BNL Core Research Programs & Center for Functional Nanomaterials (CFN)*
- *Industry (GE, IBM, Exxon, others...)*

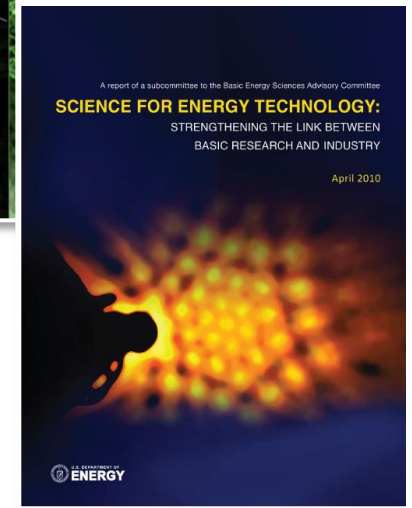
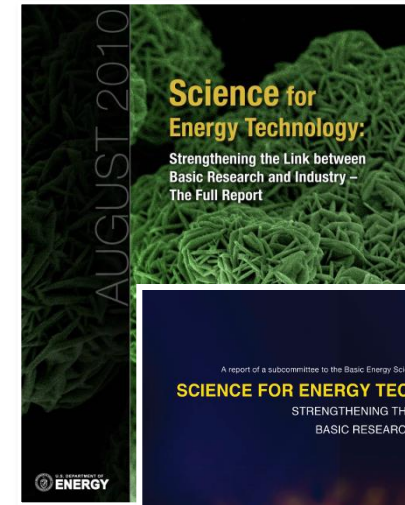
Science and Technology Research Spectrum



BESAC Science for Energy Technology Report

“BES-supported user facilities should seek to increase the level of industrial participation and use by

- Refining its access policies, proposal selection criteria, and time allocations to more fully engage industry-based clean energy research
- Investigating how its beamlines and instrumentation could be adapted to the priority research directions and needs of industry
- Engaging its beamline scientists and support staff to provide greater assistance to industrial users solving critical challenges in development and deployment of clean energy technologies.”



NSLS-II User Access Policy – Guiding Principles

- Scientific Access: Two principles underlie all scientific user access to beam time:
 - The first is that it is based on proposals that are subjected to peer review that is fair, clear, and expedient, that is sensitive to the needs of users, and that recognizes contributions that improve the overall scientific program.
 - The second is that all proposals receive a finite amount of beam time for a limited duration that is justified by the need for beam time of the proposed work.
- Proprietary Access: Reviewed and approved by PS management
 - With full cost recovery following the standard DOE process



NSLS-II Scientific Access

– General & Partner Users

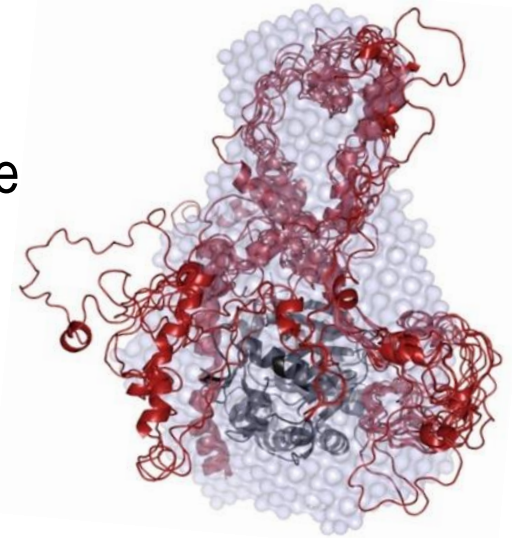
- Three modes of scientific user access:
 - General User (GU) access (min. 50%)
 - Partner User (PU) access (up to 40%)
 - Beamline staff access (10%)
- General User (GU) Proposal
 - Valid for up to 2 years
 - May request multi-cycle status
 - Include remote and mail-in access
- Partner User (PU) Proposal
 - Must indicate PU contributions to enhance capabilities and operations
 - May request up to 40% of the available user beam time per run cycle
 - Valid for up to 3 years (up to 5 years in special cases)
- Examples of PU Contributions:
 - contributing a sophisticated endstation
 - contributing staff & equipment to provide user support for a given program
 - construction or operation of a beamline

Evaluation Criteria:

- Scientific and/or technical innovation and originality
- Scientific, technical, and/or industrial importance
- Education and/or outreach importance
- Capability of proposal group and quality of past performance based on track record (publications, patents, ...)
- Experimental plan and technical feasibility

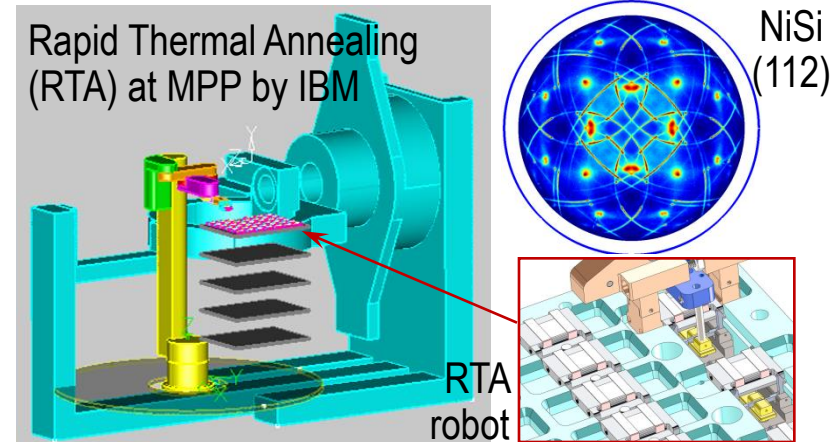
Rapid Access

- Rapid Access process provides a mechanism for short-turnaround allocation of GU beam time for urgent needs that arise between formal review and allocation run cycles
 - Beamline specifies a percentage of GU time (e.g. 10%) for Rapid Access prior to BAC allocation for each run cycle
 - Submitted GU proposals requesting Rapid Access are considered on a continuing basis and are not subject to evaluation cycle deadlines
 - To permit timely access, the proposal is sent to the requested beamline at the same time it is sent to PRP
 - Beamline may choose to award beam time and schedule the user's visit before the review is completed. If so, the normal review process will still take place, with the conclusions evaluated retrospectively
 - Beamline provides a list of scheduled Rapid Access proposals to the BAC prior to its next scheduled meeting. The BAC provides oversight of the Rapid Access proposal process by evaluating the beam time usage retrospectively and making recommendations to PS management



Industrial Usage through Rapid Access

- Rapid Access may be one of the ways to meet the needs for timely beam time access by industry users on NSLS-II workhorse instruments where such Rapid Access modes are feasible:
 - X-ray powder diffraction
 - Small angle X-ray scattering (SAXS)
 - X-ray reflectivity
 - Macromolecular crystallography (MX)
 - X-ray absorption spectroscopy (XAS)
- These workhorse beamlines at NSLS-II are typically equipped with automated sample changers, robotics control, and user friendly interfaces and analysis
- Rapid Access percentage can be made commensurate with user demands
- Additional scientific support may be available for pre-experiment planning and post-experiment analysis and reporting, as well as evaluation of the needs for accessing more advanced techniques at other NSLS-II beamlines



Balanced Distribution of Access Modes for Optimum Productivity and Impact

- Optimum distribution of beam time awarded to GU proposals as either standard allocations, multi-cycle allocations, or rapid access allocations is expected to vary depending on the area of science and the nature of the technique
- Total amount of GU beam time allocated for multi-cycle access in any given run cycle will not exceed a specified percentage of the total available GU time for that beamline for that run cycle
- This is to ensure that a reasonable amount of beam time will always be available for new proposals that are highly rated and for Rapid Access proposals
- Target distribution of beam time among these types of access mechanisms will be determined on a beamline-by-beamline basis based on recommendations by the beamline staff, and requires the approval of PS management and periodic reviews by the SAC

This Workshop

- This Workshop brings together: *attendees: >60% from industry*
- Industrial scientists interested in utilizing advanced characterization tools at SR's in solving technical problems
- Synchrotron facilities scientists interested to see how their curiosity-inspired science could lead from science to technology
- Industrial managers interested in learning how their companies could benefit from the access to advanced x-ray characterization techniques
- Industrial, facility, and academia researchers/managers interested in working together in breaking down barriers for seamless access of users facility in a timely manner
- We look forward to the discussions in the next 2 days and the Workshop Report



Summary

- With NSLS-II first e- beam stored on April 5, and first beam to beamlines expected by August 2014, NSLS-II is entering an exciting phase of transitioning into early science operations
- NSLS-II strategic plan identifies priority research areas and emerging science themes that drive the development of scientific facilities at NSLS-II
- NSLS-II User Access Policy set to encourage broad range of user research including ensuring timely access to industry communities
- We continue to look for ways to enhance industry access and industry research support at NSLS-II, to ensure not only scientific productivity but also societal impact of the new NSLS-II facility

Discovery Research

Use-inspired Basic Research

Applied Research

Technology Maturation
& Deployment

Thank You